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**EUROPEAN PATENT OFFICE****IPEA****1AP9 Rec'd PCT/PTO 24 MAR 2006****D-80298 MÜNCHEN,****GERMANY**

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Turin, April 20, 2005

Our Case E-1837/03

Dear Sirs,

**Re: International Application No. PCT/IT2003/000568**  
**SO.L.E.S. - SOCIETA' LAVORI EDILI E SERBATOI S.P.A.**

According to Art. 34(2)(b) and Rule 66.1(b) of the Patent Cooperation Treaty, we submit a voluntary amendment of the International Patent Application in object; please find enclosed herewith a copy of new pages 1-4 and 45-47 replacing the corresponding original pages 1-4 and 45-50.

Pages 1-4 have been amended in view of the amending of the claims and also for identifying the cited prior art.

- Original claims 94-110 have been canceled.
- Original claims 111 and 112 (actual claims 94 and 95) have been amended so as to be dependent on claim 1.
- Original claim 113 corresponds to actual claim 96.
- Original claims 114-118 (actual claims 97-101) have been amended so as to be dependent on actual claim 96.

Relating to actual claim 96 (original claim 113), we would point out that claim 96 recites a metal pile for constructing a

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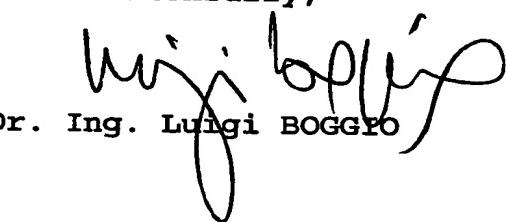
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pile foundation according to the method as claimed in any one of Claims 1 to 95 and having a main head, the transverse dimensions of the which are greater than those of a hole when driving the main head into the ground. US5234287A1 does not show, disclose or even suggest a pile having a main head, the transverse dimensions of the which are greater than those of a hole when driving the main head into the ground.

Please note that US5234287A1 discloses that "The end cap 34, being slightly larger than the pier sections 30 clears the way and reduces skin friction." (column 5, lines 10-12); this does not means that the end cap 34 is larger than the hole through the foundation 2 (which is much larger than the pier sections 30).

Yours faithfully,

Dr. Ing. Luigi BOGGIO

A handwritten signature in black ink, appearing to read "Luigi BOGGIO".

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## METHOD OF CONSTRUCTING A PILE FOUNDATION

10 TECHNICAL FIELD

The present invention relates to a method of constructing a pile foundation, in particular of a building.

BACKGROUND ART

15 A pile foundation of a building is constructed by building a ground foundation structure of the building, having at least one through hole and fitted through, adjacent to the hole, with at least two cables fixed to the structure and projecting upwards. Once the foundation  
20 structure is completed, a metal pile is inserted through the hole and subjected to a series of static thrusts to drive it into the ground; and, once driven, the top of the pile is fixed axially to the foundation structure. Each thrust is applied by a thrust device, which is set  
25 up on top of the pile, cooperates with the top end of the pile, and is connected to the projecting portions of the cables, which, when driving the pile, act as reaction members for the thrust device.

The pile comprises a constant-section rod; and a wide bottom head, which is connected integrally to the rod and substantially the same size across as the hole so as to fit through it. When driving the pile, the head 5 forms, in the ground, a channel larger across than the rod, and, as the pile is being driven, substantially plastic cement is fed into the part of the channel not occupied by the rod, so as to form a cement jacket about the pile.

10 Especially in soft ground, the transverse dimensions of the head should be particularly large to form a relatively large channel in the ground and, hence, a cement jacket large enough to ensure the required stability. The transverse dimensions of the head, 15 however, are limited by those of the hole, which, over and above a given size, seriously impairs the capacity of the foundation structure, and makes it difficult to fix the sunk pile axially to the foundation structure.

US5234287A1 discloses an apparatus and a process for 20 stabilizing foundations; a foundation having a wall is stabilized by attaching a bracket to the wall, coupling a jacking apparatus to the bracket, inserting pier sections into the jacking apparatus and driving them with that apparatus, one after the other, through the bracket and 25 into the soil which underlies the foundation, and coupling the pier so formed to the bracket so as to support the foundation through the pier. The bracket has a plate which fits against the wall and is attached to it

with bolts and a sleeve which is attached firmly to the plate intermediate the ends of the plate; the pier passes through the sleeve and is connected to the sleeve, once it encounters adequate resistance, so as to support the  
5 foundation.

US3786641A1 discloses a method for providing solid columnar support under structural layer, overlying earth materials of an earth situs. Expansible agitator means projected through relatively small diameter hole in  
10 overlying layer and expanded to agitate and loosen earth materials to define elongated body thereof of greater peripheral size than hole; self-hardenable fluid pumped through hole into loosened earth, is allowed to harden after removal of contracted agitator means through small  
15 hole. Resultant rigid, composite column underlies area of structural layer surrounding hole for the solid support of same.

#### DISCLOSURE OF INVENTION

It is an object of the present invention to provide  
20 a method and a pile of constructing a pile foundation, designed to eliminate the aforementioned drawbacks, and which, at the same time, are cheap and easy to implement.

According to the present invention, there is provided a method and a pile of constructing a pile  
25 foundation, as recited in the attached claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A number of non-limiting embodiments of the present invention will be described by way of example with

reference to the accompanying drawings, in which:

Figure 1 shows a schematic front section of a foundation pile which is driven using the method according to the present invention;

5       Figure 2 shows a section along line II-II of the Figure 1 pile;

Figure 3 shows a larger-scale front section of an initial configuration, prior to driving the Figure 1 pile;

10      Figure 4 shows the Figure 1 pile driven in;

Figures 5 and 6 show two stages in the driving of an alternative embodiment of the Figure 1 pile;

15      Figures 7 and 8 show larger-scale front sections of two alternative embodiments of a detail of the Figure 1 pile;

Figure 9 shows a front section of a further embodiment of the Figure 1 pile;

20      Figure 10 shows a larger-scale front section of an initial configuration, prior to driving an alternative embodiment of the Figure 1 pile;

differing in shape and/or thickness.

91) A method as claimed in one of Claims 1 to 89, wherein the pile (3) comprises a jacket of cement material (31) surrounding the rod (9); the transverse dimension of the jacket of cement material (31) of the pile (3) differing along the longitudinal axis of the pile (3).

92) A method as claimed in Claim 91, wherein the difference in the transverse dimension of the jacket of cement material (31) is achieved by adjusting the transverse dimension of the main head (10) as the main head (10) is driven in.

93) A method as claimed in Claim 91, wherein the difference in the transverse dimension of the jacket of cement material (31) is achieved by differentially injecting the cement material (31) through at least one through hole (52) formed along the rod (9).

94) A method as claimed in one of Claims 1 to 93, and further comprising the steps of driving at least one auxiliary pile into the ground (2) when building the foundation structure (1); and removing the auxiliary pile once the foundation structure (1) is completed; to remove the auxiliary pile, the auxiliary pile is subjected statically to pull generated by an extracting device connected mechanically at one end to a top end of the auxiliary pile, and resting at the other end on the foundation structure (1), which acts as a reaction member for the extracting device.

95) A method as claimed in Claim 94, wherein the extracting device comprises at least two hydraulic jacks on opposite sides of the auxiliary pile; the movable output member of each hydraulic jack being connected 5 mechanically to the auxiliary pile; and the bodies of the two hydraulic jacks resting on the foundation structure (1).

96) A metal pile (3) for constructing a pile foundation according to the method as claimed in one of 10 Claims 1 to 95; the pile (3) comprises a rod (9), and at least one bottom main head (10) and is inserted through a through hole (4) in a foundation structure (1) on the ground (2), so that the main head (10) of the pile (3) contacts the ground (2); at least one thrust is applied 15 statically on the pile (3) to drive the pile (3) into the ground (2); and the driven pile (3) is fixed axially to the foundation structure (1); the pile (3) is characterized in that the transverse dimensions of the main head (10) are greater than those of the hole (4) 20 when driving the main head (10) into the ground.

97) A pile (3) as claimed in Claim 96, wherein the main head (10) is pointed.

98) A pile (3) as claimed in Claim 96 or 97, wherein the rod (9) differs in thickness and/or shape along the 25 longitudinal axis of the pile (3).

99) A pile (3) as claimed in Claim 96, 97 or 98, further comprising a jacket of cement material (31) surrounding the rod (9); and the transverse dimension of

the jacket of cement material (31) of the pile (3) differing along the longitudinal axis of the pile (3).

100) A pile (3) as claimed in Claim 99, wherein the jacket of cement material (31) at an intermediate segment 5 of the pile (3) has a larger transverse dimension than at a top end segment of the pile (3).

101) A pile (3) as claimed in Claim 99, wherein the jacket of cement material (31) at a bottom segment of the pile (3) has a larger transverse dimension than at a top 10 end segment of the pile (3).